

# **EXHIBIT 9**

**BRIAN HAGGARD, PhD, 4-16-09**

1

1 IN THE UNITED STATES DISTRICT COURT FOR THE  
2 NORTHERN DISTRICT OF OKLAHOMA  
3  
4

5 W. A. DREW EDMONDSON, in his )  
6 capacity as ATTORNEY GENERAL )  
7 OF THE STATE OF OKLAHOMA and )  
8 OKLAHOMA SECRETARY OF THE )  
9 ENVIRONMENT C. MILES TOLBERT, )  
10 in his capacity as the )  
11 TRUSTEE FOR NATURAL RESOURCES )  
12 FOR THE STATE OF OKLAHOMA, )

13 Plaintiff, )

14 vs. )

15 TYSON FOODS, INC., et al, )

16 Defendants. )

17 - - - - -  
18 THE VIDEOTAPED DEPOSITION OF  
19 BRIAN HAGGARD PhD, produced as a witness on  
20 behalf of the Plaintiff in the above styled and  
21 numbered cause, taken on the 16th day of April,  
22 2009, in the City of Fayetteville, County of  
23 Washington, State of Arkansas, before me, Lisa A.  
24 Steinmeyer, a Certified Shorthand Reporter, duly  
25 certified under and by virtue of the laws of the  
State of Oklahoma.

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**918-587-2878**

**BRIAN HAGGARD, PhD, 4-16-09**

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I N D E X

W I T N E S S	P A G E
BRIAN HAGGARD, PhD	
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**BRIAN HAGGARD, PhD, 4-16-09**

**11**

1 Q Thank you.

2 A Chemical engineering department.

3 Q Then you obtained your doctorate at Oklahoma  
4 State University in biosystem engineering in the  
5 year 2000. Tell us, if you would, who was your  
6 advisors on your thesis there.

08:45AM

7 A Dr. Dan Storm was my dissertation advisor.

8 Q On the committee, who were they?

9 A Dr. Mike Smolen, Dr. Tom Honn and Dr. Emily  
10 Stanley.

08:45AM

11 Q As of January 1 when your resu<sup>m</sup>T or curriculum  
12 vitae was prepared, is it accurate and complete as  
13 far as you know?

14 A I believe so. There might -- there could be  
15 some grants that are left off because I haven't  
16 updated it.

08:46AM

17 Q Okay, but at the time it's pretty much  
18 complete as far as you can tell?

19 A Yes, sir.

20 Q All right. Let's talk about your employment  
21 history. Why don't we start when you first had what  
22 you considered to be a real job either in college or  
23 after college.

08:46AM

24 A My first real job was working for M&M  
25 Environmental Consulting in Fort Smith, Arkansas,

08:46AM

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1 the summer after I finished my bachelors degree.

2 Q What kind of work did you do there?

3 A Mostly stabilization of chemicals for their  
4 disposal into municipal landfills.

5 Q How long did that last? 08:46AM

6 A Two months.

7 Q And what time frame were you talking about  
8 that that occurred?

9 A That would be June through approximately  
10 August 1994. 08:47AM

11 Q Okay. What would be your next employment  
12 after that?

13 A At that point I went to graduate school, and I  
14 did not hold a real job until I was hired by the  
15 U. S. Geological Survey in January of 2000. 08:47AM

16 Q All right. Is that shown then on your  
17 curriculum vitae, Exhibit 7, as the hydrologist in  
18 the Tulsa office in 2000 to 2002?

19 A Yes, sir.

20 Q Okay, and what were your responsibilities  
21 there as a hydrologist? 08:47AM

22 A Water quality data analysis.

23 Q And how long did that position last?

24 A I was with the U. S. Geological Survey from  
25 2000 through about August 2001. 08:47AM

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**13**

1 Q Starting when in 2000?

2 A January 2000.

3 Q Okay.

4 A Through August 2001.

5 Q Okay. Your next position then was as a 08:47AM  
6 research hydrologist with the USDA; is that correct?

7 A That's correct.

8 Q And that was through 2004 based on your  
9 Exhibit 7?

10 A I have that listed out how I progressed 08:48AM  
11 through the federal grades. So I was employed by  
12 the USDA from August 2001 through January 2006.

13 Q Okay. Tell us a little bit about what your  
14 job responsibilities were with the USDA.

15 A The main general focus was tackling water 08:48AM  
16 quality issues in northwest Arkansas as related to  
17 the poultry industry.

18 Q And what were your duties or responsibilities  
19 in that regard?

20 A To conduct scientific studies, to evaluate the 08:48AM  
21 effects of land use on chemical concentrations in  
22 streams.

23 Q Okay. As part of that work, were you required  
24 to publish your findings from the research you  
25 performed? 08:49AM

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1       **A**       Yes, sir.

2       **Q**       And you did do so?

3       **A**       Yes, sir.

4       **Q**       Okay. Are those publications listed on your  
5 curriculum vitae?

08:49AM

6       **A**       Yes, sir.

7       **Q**       Was your area of study then limited to the  
8 northwest Arkansas area at that time?

9       **A**       By proximity.

10      **Q**       What were the elements of concern or  
11 constituents of concern that you were researching or  
12 studying?

08:49AM

13               MR. BURNS: Object to form.

14      **A**       Could you rephrase the question, please?

15      **Q**       Yeah. What kind of chemicals that might  
16 impact land uses were you concerned with or  
17 studying?

08:49AM

18               MR. BURNS: Object to the form.

19      **A**       Again, could you simplify that?

20      **Q**       Okay. Let's talk a little bit about what you  
21 did maybe.

08:49AM

22      **A**       Yes, sir.

23      **Q**       Did you do field research and sampling and  
24 sample collection?

25      **A**       I did some plot studies. The majority of my

08:49AM

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1 work was sampling in streams.

2 Q Okay. When you sampled in streams, what were  
3 you sampling for?

4 A We focused on nitrogen and phosphorus  
5 concentrations. 08:50AM

6 Q Okay. When you say we, who do you mean by we?

7 A Me and my research staff, the people that  
8 worked for me --

9 Q And how many was that?

10 A -- I've had -- 08:50AM

11 Q Roughly?

12 A -- on average two to three people per year,  
13 one full-time research associate.

14 Q After your position at USDA, you became an  
15 associate professor at the University of Arkansas;  
16 is that correct? 08:50AM

17 A Yes, sir.

18 Q And you still hold that title there today?

19 A Yes, sir.

20 Q Okay, and as I understand it, you are now the  
21 director at the Arkansas Water Resource Center;  
22 correct? 08:50AM

23 A As of July last year, yes, sir.

24 Q Good. All right. Were you an interim  
25 director before that? 08:50AM

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1 providing the technical review.

2 Q All right, they give feedback, though, and  
3 it's unidentified?

4 A Yes. It's identified as Reviewer No. 1, 2, 3,  
5 depending upon how many technical reviews there 08:58AM  
6 were.

7 Q I'm going to look at the abstract of the  
8 paper, and a couple or three sentences down it says,  
9 the objective of this study was to evaluate the  
10 effect of broiler litter application rate on runoff 08:58AM  
11 water quality in response to natural precipitation.  
12 Is that a fair statement of what was done for this  
13 study?

14 A Yes, sir.

15 Q All right. Where was the study conducted? 08:59AM

16 A At the Arkansas Agricultural Research and  
17 Extension Center here in Fayetteville, Arkansas.

18 Q Okay. Is that the same thing that's referred  
19 to as the Savoy Experimental Station?

20 A No, sir. 08:59AM

21 Q Okay. So there are two separate stations?

22 A Yes, sir.

23 Q What was used in the study; did you have study  
24 plots?

25 A We had small plots. 08:59AM

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**23**

1 Q And basically just describe what those are for  
2 the court, if you would, please?

3 A They're -- they are a certain size, sometimes  
4 five by twenty feet, and they are bermed at each end  
5 either with metal or with wood to hydrologically 08:59AM  
6 isolate a particular land area. At the down slope  
7 end there's a runoff trough that's used to collect  
8 the runoff water.

9 Q Are these plots -- have they to your knowledge  
10 been used in prior studies? 08:59AM

11 A Yes, sir, I believe they were.

12 Q And do you remember what studies they might  
13 have been used for?

14 A Not the particular studies, but it would have  
15 been studies conducted by Dr. Daniels and Dr. Dwayne 09:00AM  
16 Edwards back in the early to mid '90s.

17 Q Okay. Other than the -- I'm not sure what you  
18 call it -- the flute at the end to catch runoff, are  
19 there any other types of instrumentation applied on  
20 plots to measure either water flow or other 09:00AM  
21 characteristics?

22 A When working with the natural precipitation as  
23 of this case, they had a covered bottle that was  
24 attached to the end of the flume where the runoff  
25 water was collected, and that's where they collected 09:00AM

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**24**

1 their water samples.

2 Q Okay. Any other type of instrumentation used  
3 besides that?

4 A Not in this study.

5 Q Okay. Tell the court what kind of waste was 09:00AM  
6 applied on these plots that was being studied.

7 MR. BURNS: Object to form.

8 A Poultry litter was applied to these plots.

9 Q Okay, and what was the source of the poultry  
10 litter that was used? 09:01AM

11 A I am not aware of where exactly where it came  
12 from.

13 Q Okay. Do you know what the rate of  
14 application was in the study?

15 A I would have to review the document. 09:01AM

16 Q All right. Why don't you look at that?

17 A Based upon the abstract, the application rates  
18 were zero, 5.6 and 11.2 megagrams per hectare.

19 Q And would relate to approximately two and a  
20 half to five tons of pounds per acre application 09:01AM  
21 rate?

22 A I would have to do the conversions but --

23 Q I should not say pounds. Actually it would be  
24 approximately two and a half to five tons per acre  
25 application rate? 09:01AM

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1 to 50 inches per year.

2 Q Do you know whether or not through the study  
3 period that the average was in fact occurring over  
4 the four-year period?

5 A No, I do not. 09:03AM

6 Q Okay. Let's look at Page 1008 of the paper  
7 under Results and Discussions.

8 MR. ELROD: What page, Rick?

9 MR. GARREN: 1008.

10 Q I apologize. There was a quote I wanted you 09:04AM  
11 to read and look at, and I can't seem to see where I  
12 put it, where it's located. Oh, go to the next page  
13 and under the Vegetative Response, the very last  
14 sentence in that paragraph heading where it says,  
15 though not formally compared, numerically lower DM 09:04AM  
16 yields in year three were likely the result of the  
17 37 percent below average precipitation that occurred  
18 in that year of 2006 or in that year. Do you see  
19 that, the very last sentence?

20 A Very last sentence? 09:05AM

21 Q Yes. Do you see where there it reports there  
22 was a 37 below percent average precipitation that  
23 occurred that year; do you see that statement?

24 A Yes, sir.

25 Q So at least in one year there was a below 09:05AM

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1 average or somewhat below average of typical  
2 rainfall?

3 **A** Yes, sir.

4 **Q** Okay. Do you know what effect, if any, the  
5 lower rainfall had in this study? 09:05AM

6 **A** Not specifically without reading through the  
7 study again.

8 **Q** Okay. Tell the court, if you would, please,  
9 what -- generally what chemicals or items are being  
10 studied in this research. 09:05AM

11 **A** In this study, the graduate student looked at  
12 the concentrations of various elements that are  
13 measurable by ICO inductively coupled plasma optical  
14 emission spectrometry. It's a machine that's able  
15 to analyze about 20 elements for us at once, as well 09:06AM  
16 as nitrogen and phosphorus and then some of the soil  
17 parameters.

18 **Q** So soluble nutrients would be one example  
19 perhaps?

20 **A** Yes, sir, in a general sense. 09:06AM

21 **Q** And metals?

22 **A** Yes, sir.

23 **Q** Okay. In this study, were runoff losses  
24 different for the control versus the litter-applied  
25 plots; do you know? 09:06AM

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1       **A**       Again, I would have to -- it has been a while  
2       since I read this. I would have to reread.

3 Q All right. Do you know, sir, whether or not  
4 the plots which were litter applied reflected  
5 greater runoff of nutrient concentrations than those 09:06AM  
6 that were not applied?

7     **A**       I would have to reread the study to see which  
8     plots had the highest runoff volumes.

9 Q You don't recall generally yourself here  
10 today? 09:07AM

11       **A**       No, sir, I don't.

12 Q Let's look back in the abstract then which is  
13 probably easier to find and near the bottom, if I  
14 can point to an area where it starts, the four-year  
15 flow-weighted main -- or mean; do you see that 09:07AM  
16 there?

17 |     **A**     The flow-weighted concentrations?

18 Q Yes. Read where that starts to the end of the  
19 sentence, and the four year FWM, which is  
20 flow-weighted mean -- 09:07AM

21       **A**       Phosphorus concentration from the low litter  
22       treatment was greater than that from the unamended  
23       control.

24 Q All right. Does that refresh your  
25 recollection of what occurred in the study? 09:07AM

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1       **A**       Yes, sir. There were higher concentrations  
2       from that plot than the control study.

3       **Q**       Okay, and those concentrations were in this  
4       case talking about phosphorus; is that right?

5       **A**       Yes, sir. 09:08AM

6       **Q**       Was any simulated rainfall used in this study  
7       for the four-year period?

8       **A**       No, sir.

9       **Q**       So all of this is actual rainfall that's being  
10      measured across these plots? 09:08AM

11      **A**       Natural precipitation, yes, sir.

12      **Q**       All right. Have you -- do you have experience  
13      yourself with working in studies that used rainfall  
14      simulations?

15      **A**       Yes, sir. 09:08AM

16      **Q**       Tell the court, if you would, what's the  
17      purpose of using a rainfall simulator.

18      **A**       A rainfall simulator gives the investigator  
19      the ability to control how much rainfall each plot  
20      receives. 09:08AM

21      **Q**       Is there any objective in using a simulator to  
22      comparing it to natural rainfall?

23      **A**       Not in my mind, no, sir.

24      **Q**       Okay. Is there any reason to -- well, is  
25      there -- is it generally the intent to try and 09:09AM

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30

1 replicate natural rainfall events when using  
2 simulators?

3 **A** No, sir.

4 **Q** Why would you not try and simulate or  
5 replicate natural rainfall using the simulator? 09:09AM

6 **A** When I have personally used in the rainfall  
7 studies we did, we ran between five and seven  
8 centimeters per hour, which is very, very intense  
9 storm event, because we want to generate runoff as  
10 quickly as possible to speed the study along because 09:09AM  
11 the majority of the time we are working with 28 or  
12 more plots at one time.

13 **Q** Okay. So it's more of a convenience then in  
14 order to get the runoff quicker; is that what you're  
15 saying? 09:09AM

16 **A** It is, and it also would replicate being that  
17 intense of a storm event, kind of a worst case  
18 situation.

19 **Q** Is the study that we're seeing in Exhibit 2,  
20 because it's natural rainfall, it's different in 09:10AM  
21 what its objective is; is that a fair statement?

22 MR. BURNS: Object to form.

23 **Q** Let me put it this way: As compared to a  
24 rainfall simulation that you just described, the  
25 objective is different in this study in Exhibit 2; 09:10AM

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1 Q Okay. In this case that would have been who;  
2 do you remember?

3 A I believe the author list would probably  
4 denote Dr. Gbur, myself, Dr. Brye, and honestly I  
5 don't remember who the other departmental members 09:46AM  
6 were on this committee.

7 Q Okay. Let me hand you what's been marked as  
8 Exhibit 3, Dr. Haggard, and ask you again if you  
9 could identify that document.

10 A Yes, sir, I can. This is a publication by 09:47AM  
11 Mansoor Leh, a graduate student in the department  
12 that I'm housed in.

13 Q Were you one of the investigators in this  
14 study?

15 A Yes. I was a co-investigator. 09:47AM

16 Q And you were also then a co-author; is that  
17 correct?

18 A Yes, sir.

19 Q Did you read and approve the content of the  
20 paper prior to its publication? 09:47AM

21 A Yes, I did.

22 Q Were the opinions, findings and conclusions  
23 made by you in this paper accurate and true at the  
24 time they were made?

25 A As best of my knowledge. 09:47AM

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1 Q Are there any facts or events that would cause  
2 you to change any of the opinions, findings or  
3 conclusions in this paper at this time?

4 A Not to my knowledge.

5 Q Are you aware of any other published papers 09:47AM  
6 who have criticized the data compiled in this study?

7 A No, sir, I'm not.

8 Q Are you aware of any other published papers  
9 that have criticized the methodology used in this  
10 study? 09:48AM

11 A No, sir, I'm not.

12 Q Look in the abstract and tell me, sir, I think  
13 the second sentence says it, I'll go ahead and read  
14 it. The objective of the study was to use a field  
15 scale approach to delineate critical runoff source 09:48AM  
16 areas and to determine the runoff mechanisms in a  
17 pasture hill slope of the Ozark Highlands in the  
18 USA. Did you work in the field in this study  
19 research?

20 A No, sir, I did not specifically do any of the 09:48AM  
21 field work.

22 Q All right. Did you go to the field and  
23 observe how it was set up?

24 A Yes, sir.

25 Q The location is listed as the Savoy 09:48AM

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1 experimental watershed, which is northwest of -- in  
2 the northwest part of Arkansas. That's a different  
3 location than we talked about from the previous  
4 study in Exhibit 2; correct?

5 **A** Yes, sir. 09:49AM

6 **Q** And was this study using actual fields as  
7 opposed to smaller plots?

8 **A** Yes, sir. It used a pasture hill slope.

9 **Q** All right, and I've deposed Dr. Chaubey, and  
10 I'm familiar with some of his work in this area. So 09:49AM  
11 is this the same plot area or field area where he  
12 conducted his infiltration saturation studies with a  
13 significant amount of instrumentation on the hill  
14 slope; do you remember?

15 **A** This is the site where he had surface runoff 09:49AM  
16 sensors to determine if surface runoff was occurring  
17 and subsurface sensors to see if the soil was  
18 saturated up to the soil-air interface.

19 **Q** Were those same sensing instrumentation  
20 mechanisms in place for this study? 09:50AM

21 **A** Yes, sir, I believe so.

22 **Q** Okay. Is this then sort of a continuation of  
23 the study that he performed before leaving the  
24 University of Arkansas?

25 **A** I believe this is a publication of that study. 09:50AM

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1 Q Okay. What was the overall goal of the study,  
2 if you would, please?

3 A We were trying to determine whether runoff --  
4 which runoff mechanism produced runoff, whether it  
5 was infiltration excess or saturation excess. 09:50AM

6 Q Was -- was the overall goal of the objective  
7 accomplished in this study?

8 A It was.

9 Q And what was the dominant runoff mechanism  
10 determined from this study? 09:50AM

11 A Let me review the document, please.

12 Q All right.

13 A This study showed that both infiltration and  
14 saturation excess runoff is occurring, and that zero  
15 to 58 percent of the runoff was from infiltration 09:51AM  
16 excess, whereas zero to 26 percent was from  
17 saturation excess.

18 Q Okay. In this study then am I correct in  
19 saying that both surface and subsurface field and  
20 watershed characteristics were being measured? 09:51AM

21 A Yes, sir.

22 Q All right. Is the land use of the Savoy  
23 experimental watershed representative of typical  
24 pasture-dominated agricultural fields in the Ozark  
25 Highlands? 09:52AM

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1       **A**       It is representative of that region.

2       **Q**       All right. Look at -- they're not numbered.

3       It's the next to the last page, it looks like, at

4       the bottom of your summary and conclusions section,

5       and the last sentence, it says, this methodology 09:53AM

6       provides a detailed procedure for capturing the

7       hydrologic activities that occur on a hill slope and

8       provides benchmark procedures that can be used in

9       locating areas for best management practice

10      implementation. Did I read that correctly? 09:53AM

11      **A**       Yes, sir, you did read it correctly.

12      **Q**       Were you able in this study to accurately

13      identify and describe the hydrologic activities

14      occurring at the Savoy study site?

15      **A**       At this particular hill slope, we were able to 09:53AM

16      determine where infiltration and saturation excess

17      did occur.

18      **Q**       How -- how -- well, I think you've answered

19      this. In the -- in the same paragraph it says that,

20      midway down, the infiltration excess runoff 09:54AM

21      mechanisms -- mechanism areas were located primarily

22      in areas of high soil electrical resistance, while

23      saturation excess mechanisms -- mechanism areas were

24      located in subsurface fractures. What does it mean

25      by electrical resistance? 09:54AM

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1       **A**       I have to admit that I'm not an expert in the  
2       use of these geophysical tools to determine that.

3       **Q**       Okay. Go further up then in the summary and  
4       conclusions. The second sentence, it says, results  
5       from this study showed that both infiltration excess       09:55AM  
6       and saturation excess runoff processes occurred on  
7       this hill slope. Let's talk about those two  
8       concepts. Saturation basically is what to a layman;  
9       how do you describe that?

10      **A**       The soil would be full of water.                       09:55AM

11      **Q**       All right.

12      **A**       Would be saturation.

13      **Q**       And so when rain hits soil that's full of  
14      water, what happens?

15      **A**       The rainfall cannot infiltrate to the soil, so       09:55AM  
16      it runs off.

17      **Q**       Okay. Let's talk about the other process,  
18      infiltration. What is infiltration from a layman's  
19      standpoint?

20      **A**       It is the movement of water through the soil       09:55AM  
21      profile.

22      **Q**       And what happens in that circumstance where  
23      the rainfall would actually run off; what's  
24      occurring?

25      **A**       Generally the rainfall rate has exceeded the       09:55AM

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1 infiltration rate, so not all of the water can move  
2 into the soil, and a portion of it runs off.

3 Q All right. So you've got two processes that  
4 you've identified that allow rainfall to run off a  
5 field; is that a correct statement? 09:56AM

6 A Yes, sir.

7 Q Okay. For purposes of this study and the  
8 methodology that was to help in best management  
9 practices, did you attempt to identify areas of this  
10 hill slope where runoff actually occurs then? 09:56AM

11 MR. BURNS: Object to form.

12 A The site was instrumented, such that we would  
13 know where surface runoff was occurring.

14 Q Was part of the purpose in this study to  
15 identify those parts of the field that either are 09:56AM  
16 more or less susceptible to runoff?

17 A Yes. We identified the parts of the field  
18 that -- where runoff occurred under different  
19 precipitation events that occurred throughout the  
20 time period of the study. 09:57AM

21 Q Look back a page and there's -- actually the  
22 next two or three pages. We have various figures in  
23 here that show these hill slope plots; correct?

24 A Yes, sir.

25 Q And those are designated or identified as to 09:57AM

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1 the areas of the plots and how the particular  
2 process was occurring; is that correct?

3 **A** Yes, sir.

4 **Q** Okay. Are you aware if there had been  
5 previous studies looking at delineating runoff 09:57AM  
6 surface waters in watersheds?

7 **A** Could you repeat the question?

8 **Q** Yeah. Are you aware if there were previous  
9 studies that looked at delineating runoff surface  
10 areas in a watershed besides this one? 09:57AM

11 **A** Yes.

12 **Q** You cite to an author named Dunne, D-U-N-N-E.  
13 Is that one of them; do you recall?

14 **A** I would have to look at the reference list.

15 **Q** Okay. 09:58AM

16 **A** In the reference list we do cite Dunne and  
17 Black papers from the 1970s.

18 **Q** Good. Thank you. What is important from this  
19 study about delineating runoff surface areas?

20 **A** To understand what mechanisms are producing 09:58AM  
21 the runoff that's leaving the hill slope.

22 **Q** Does that assist you and/or others in  
23 identifying areas where runoff may be more likely to  
24 occur from a particular site?

25 **A** That obviously assisted us in determining that 09:58AM

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1 from this hill slope.

2 Q Is that the purpose, though, when you comment  
3 about this is a good methodology to help in BMP  
4 implementation; was that the goal in a sense?

5 A The goal of this was -- this was funded 09:59AM  
6 through the USDA NRI program, and it was to  
7 demonstrate that the methodology can work in  
8 northwest Arkansas, and to show that it could be  
9 applied to other fields to delineate what's -- where  
10 saturation excess occurs or where infiltration 09:59AM  
11 excess occurs.

12 Q Okay. This may be a question of the obvious,  
13 but to do that at a different location, in your  
14 opinion, does it require all that instrumentation to  
15 be set up as was done in this study? 09:59AM

16 A It does not have to be as high density a  
17 setup.

18 Q As was used in this study?

19 A As was used in this study.

20 Q Okay. Let's look at the first page again of 09:59AM  
21 your paper, and the next to the last or the last  
22 paragraph in the left-hand column, the second  
23 sentence, it says, for example, storm runoff plays a  
24 major role in phosphorus transport, and diffuse  
25 phosphorus pollution is a major contributor to 10:00AM

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1 underdrain the soil. What is anisotropic pathways;  
2 what does that mean?

3 **A** I don't know. No, sir. I would ask Dr. Van  
4 Brahana.

5 **Q** All right. Let me hand you Exhibit No. 4 and 10:02AM  
6 ask you if you can identify it.

7 **A** This is a paper that I wrote.

8 **Q** As published in July of '03, is that correct,  
9 through the Biosystems Engineering?

10 **A** Yes, sir. 10:02AM

11 **Q** Okay. When you're the first author, does that  
12 make you the principal investigator also when you  
13 see a published paper like this?

14 **A** Generally that's how it works, yes, sir.

15 **Q** All right, and did you read and approve the 10:02AM  
16 content of the paper prior to its publication?

17 **A** Yes, sir.

18 **Q** Are the opinions, findings and conclusions  
19 made by you in this paper accurate and true at the  
20 time you made them? 10:03AM

21 **A** Yes, sir.

22 **Q** Are there any facts or events that would cause  
23 you to change any opinions, findings or conclusions  
24 that you made in this paper that you know of?

25 **A** Not that I'm aware of. 10:03AM

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1       **Q**       Are you aware of any other studies that have  
2 criticized the data compiled in this study?

3       **A**       No, sir.

4       **Q**       Are you aware of any others who have  
5 criticized the methodology used in the study? 10:03AM

6       **A**       No, sir.

7       **Q**       In the abstract, what appears to be the third  
8 sentence, it says, nitrogen and P concentrations  
9 were measured in four subwatersheds of Beaver Lake,  
10 a reservoir in the White River in Arkansas, USA, to 10:03AM  
11 assess possible relationships between pastureland  
12 use and stream nutrient concentrations and export.

13 Did I read that correctly?

14       **A**       Yes, sir.

15       **Q**       And was that generally the object of this 10:03AM  
16 study?

17       **A**       Yes, sir.

18       **Q**       When you completed the study, did you feel  
19 that your objectives were accomplished?

20       **A**       To the extent that the data statistically 10:04AM  
21 supported it, yes, sir.

22       **Q**       Okay, and did you feel that the data did  
23 statistically support it?

24       **A**       The conclusions we made, yes, sir.

25       **Q**       Okay. Do you, sir, know whether or not -- 10:04AM

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1 first off, where is the Beaver Lake watershed in  
2 relation to the Illinois River watershed; do you  
3 know that?

4 **A** It is east.

5 **Q** Do they abut each other or adjoin each other? 10:05AM

6 **A** They are adjacent watersheds.

7 **Q** Okay. Are the Beaver Lake and IRW each in  
8 what's considered the Ozark Highlands?

9 **A** Yes, sir, in that general ecoregion.

10 **Q** All right. Are there poultry operations in 10:05AM  
11 the Beaver Lake watershed?

12 **A** Yes, sir.

13 **Q** You state on the first page in the lower  
14 right-hand corner that the issue of NPS, and that  
15 would be non-point source nutrient loading; is that 10:06AM  
16 correct?

17 **A** Yes, sir.

18 **Q** Has come into sharp focus in the state of  
19 Arkansas in the last ten years due to the rapid  
20 growth of the poultry industry. Was that a true 10:06AM  
21 statement at the time you made this in 2003?

22 **A** Yes, sir.

23 **Q** Okay. Did you make a determination what was  
24 done with most of the poultry litter that is  
25 generated from the poultry growing operations in the 10:06AM

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1 Beaver Lake watershed?

2 MR. BURNS: Object to form.

3 A We assumed that it was land applied.

4 Q And what was the basis for your assumption?

5 A The general practices that are used where 10:06AM  
6 poultry litter is used to fertilize fields.

7 Q What is it about the rapid growth of the  
8 poultry industry that caused focus on nutrient  
9 loading?

10 MR. BURNS: Object to form. 10:07AM

11 A The increased number of poultry operations  
12 could suggest that you could have increased amounts  
13 of poultry litter applied to the landscape, and so  
14 we wanted to focus on -- that's why the shift of  
15 focus was to non-point source pollution. 10:07AM

16 Q Okay. Has the import of phosphorus and animal  
17 feeds resulted in a substantial accumulation of  
18 phosphorus within the watershed, such as Beaver or  
19 Illinois River watershed, where there are high  
20 densities of confined poultry operations? 10:07AM

21 MR. VARADY: I object to the form.

22 A I don't have knowledge of how the  
23 concentrations in the soils have changed over time  
24 within that basin.

25 Q Okay. Do you remember writing a paper in 2003 10:08AM

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1 that basically was P sources in Ozark catchment,

2 have we forgotten P from discrete sources?

3 **A** Yes, sir.

4 **Q** Do you remember making the statement that

5 import of phosphorus in animal fields resulted in a 10:08AM

6 substantial accumulation of P within the watershed

7 in that statement, in that report?

8 **A** I would like to review that to see the context

9 that it was written in.

10 **Q** Okay. Tell the court, if you would, please, 10:08AM

11 generally what you did in this study.

12 **A** We collected water samples at I believe ten

13 sites approximately seventeen times annually at a

14 predetermined interval.

15 **Q** And what were you -- were you sampling just 10:09AM

16 streams, groundwaters or what?

17 **A** In this study we were sampling just streams

18 during both base flow conditions and high flow

19 events.

20 **Q** All right. Look at on Page 76 the left-hand 10:09AM

21 column. Looks to be the first or second full

22 sentence down, starting the environmental

23 consequences; do you see that sentence?

24 **A** Yes, sir.

25 **Q** Okay. The environmental consequences of N, 10:10AM

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1 nitrogen-based applications included high loads of  
2 phosphorus, heavy metals and organic compounds in  
3 runoff and eventually in the receiving freshwater  
4 ecosystems. Was that statement true at the time you  
5 wrote it?

10:10AM

6 **A** Yes, sir.

7 **Q** Is there anything that would make you think  
8 that was not true today?

9 **A** Not that I'm aware of.

10 **Q** Okay. Do you know when P-based or  
11 phosphorus-based nutrient plans were mandated in  
12 Arkansas?

10:10AM

13 **MR. BURNS:** Object to form.

14 **A** Early 2000s.

15 **Q** Okay. If I told you 2006, would that refresh  
16 your recollection of mandated nutrient management  
17 plans?

10:11AM

18 **A** I thought --

19 **Q** It doesn't matter.

20 **A** If that's the date you have, but I thought it  
21 occurred earlier than that, but that could be  
22 correct.

10:11AM

23 **Q** Based upon your research in the Illinois River  
24 watershed and Beaver Lake watershed, do you consider  
25 them similar in geology?

10:11AM

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1 MR. BURNS: Object to form.

2 MR. ELROD: Object to form.

3 A I do not know if they are similar in the  
4 underlying geology.

5 Q Okay. Did you -- do you know whether or not 10:11AM  
6 they both contain Karst geology?

7 A I believe there's a higher proportion in the  
8 Illinois River basin.

9 Q Okay. Did you make any determination whether  
10 their land uses are similar, that is, the Beaver 10:12AM  
11 Lake watershed and the Illinois River watershed?

12 MR. BURNS: Object to form.

13 MR. VARADY: Object to the form. Are you  
14 asking about a specific study that he did?

15 Q Based upon the studies you've done in the 10:12AM  
16 Illinois River watershed and the study that you did  
17 in Beaver Lake, did you observe whether the land  
18 uses were similar in those watersheds?

19 A The major land uses are similar, which would  
20 be urban, pasture and forest. 10:12AM

21 Q Did you for purposes of your study in the  
22 Beaver Lake attempt to quantify the amount of  
23 pasture, urban, forested areas by percentages or  
24 anything?

25 A We did delineate that with GIS, yes, sir. 10:12AM

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1 also related to watershed size as well.

2 Q Okay. Let's break that down a little bit.

3 When you say the export of phosphorus, what does

4 that mean; export from what?

5 A That's measuring it in terms of kilograms per 10:15AM  
6 year within the stream.

7 Q Okay, and when you -- you said there were four

8 basins. Are these smaller subbasins within the

9 Beaver Lake watershed that we're studying?

10 A Yes, it is four basins. It would be Brush 10:16AM  
11 Creek, War Eagle Creek, Richland Creek and the White  
12 River.

13 Q Okay. So I apologize. Just a second. I'm  
14 trying to find a quotation here. Look back at the  
15 abstract, sir, if you would, please, and about five 10:17AM  
16 or six lines up from the bottom, there's a sentence  
17 that says, nutrient yield was from three times to  
18 over ten times greater than nutrient yields observed  
19 in regional undeveloped streams and the average of  
20 the hydrologic benchmark network of the U. S. 10:17AM

21 Geological Survey. Let me ask you a little bit  
22 about that. First off, what regional undeveloped  
23 streams were used for comparison, if you recall?

24 A I believe it was the Cossatot River and North  
25 Sylamore Creek. 10:17AM

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1 Q And are those subbasins unimpacted by poultry  
2 operations; do you know?

3 A To my knowledge, they are predominantly  
4 forest, forested areas.

5 Q All right. So when this says that the 10:18AM  
6 nutrient yield in the basins that you are reporting  
7 on was three to ten times greater, what does that  
8 tell you about where the nutrients are coming from?

9 A That the change of land use from forest to  
10 urban and pasture has increased the nutrient export. 10:18AM

11 Q Okay. How much urban area were in the four  
12 subbasins that you studied in this Beaver Lake  
13 report?

14 A I would have to look back at the table to  
15 describe the land use. 10:18AM

16 Q Do you know where that is in the paper?

17 A No, sir, I don't. Table 1 on Page 78. It's  
18 not explicitly listed there, but it would be the  
19 difference between 100 percent minus the percents of  
20 pasture and forested land should approximately 10:19AM  
21 represent the urban land use within that catchment.

22 Q Okay. So that I understand you, the first  
23 line, the Upper War Eagle Creek, if you add the  
24 pasture and forest together, you get 97 percent, so  
25 the urban would be the remaining 3 percent? 10:19AM

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